

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
25 August 2005 (25.08.2005)

PCT

(10) International Publication Number  
WO 2005/078363 A1

(51) International Patent Classification<sup>7</sup>: F25B 9/00,  
F16K 39/00, 5/00

(21) International Application Number:  
PCT/US2005/004748

(22) International Filing Date: 9 February 2005 (09.02.2005)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data  
60/544,144  
9 Feb. 2004 (2004) US

(71) Applicants: SUMITO HEAVY INDUSTRIES, LTD.  
[JP/JP]; Intellectual Property Department, 9-11, Kitashina-  
gawa 5-chome, Shinagawa-ku, Tokyo 141-8686 (JP).  
SHI-APD CRYOGENICS, INC. [US/US]; 1833 Vultee  
Street, Allentown, PA 18103-4783 (US).

(72) Inventor; and

(75) Inventor/Applicant (for US only): GAO, Jin, Lin  
[CN/US]; c/o Shi-APd Cryogenics, Inc., 1833 Vultee  
Street, Allentown, PA 18103-4783 (US).

(74) Agents: HELFGOTT, Samson et al.; Katten, Muchin,  
Zavis, Rosenman, 575 Madison Avenue, New York, NY  
10022-2585 (US).

(81) Designated States (unless otherwise indicated, for every  
kind of national protection available): AE, AG, AL, AM,  
AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN,  
CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI,  
GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE,  
KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD,  
MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG,  
PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM,  
TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM,  
ZW.

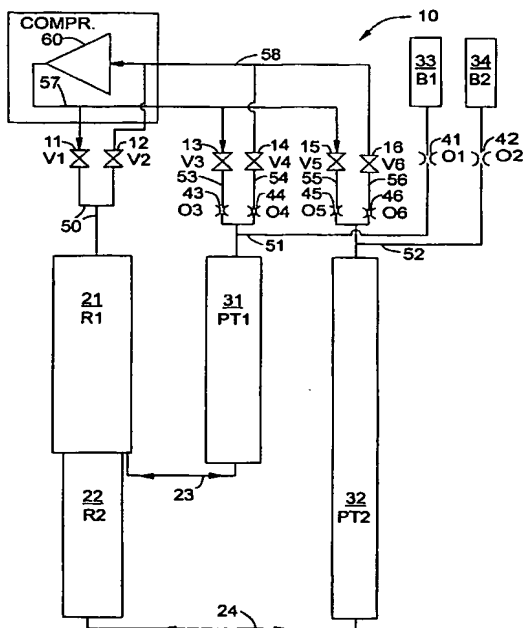
(84) Designated States (unless otherwise indicated, for every  
kind of regional protection available): ARIPO (BW, GH,  
GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM,  
ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),  
European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI,  
FR, GB, GR, HU, IE, IS, IT, LT, LU, MC, NL, PL, PT, RO,  
SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN,  
GQ, GW, ML, MR, NE, SN, TD, TG).

**Published:**

- with international search report
- before the expiration of the time limit for amending the  
claims and to be republished in the event of receipt of  
amendments

For two-letter codes and other abbreviations, refer to the "Guid-  
ance Notes on Codes and Abbreviations" appearing at the begin-  
ning of each regular issue of the PCT Gazette.

(54) Title: THREE TRACK VALVE FOR CRYOGENIC REFRIGERATOR



(57) Abstract: A multi valve two-stage pulse tube type GM refrig-  
erator having a rotary valve that comprises one track for flow to the  
regenerator and two tracks for flow to the pulse tubes where the valve  
has two high pressure ports to the pulse tubes located on a single track  
and two low pressure ports from the pulse tubes located on a separate  
single track and where there are two cooling cycles per revolution of  
the rotary face valve.

WO 2005/078363 A1